UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/727,189	12/03/2003	Robert Pezzani	S1022.81078US00	5186

23628 7590 08/05/2008
WOLF GREENFIELD & SACKS, P.C.
600 ATLANTIC AVENUE
BOSTON, MA 02210-2206

EXAMINER	
KITOV, ZEEV V	

ART UNIT	PAPER NUMBER
2836	

MAIL DATE	DELIVERY MODE
08/05/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/727,189	PEZZANI, ROBERT	
	Examiner	Art Unit	
	ZEEV KITOV	2836	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 21, 23 - 39, 41 - 45* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 - 21, 23 - 39, 41 - 45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Examiner acknowledges a submission of the amendment and arguments filed on July 21, 2008. Claims 42 – 43 are amended. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 16, 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by Switsen (US 3,598,889). Regarding claims 1 and 26, Switsen discloses a method for controlling an SCR-type switch by applying to a switch gate of the SCR-type switch (20 in Fig. 1) several periods of an unrectified high frequency voltage in succession. Since the high frequency signals are applied to the SCR gate through capacitor there is no DC component in the gating signal and therefore the signal is not rectified. Switson further discloses an accumulated effect of series of pulses on the SCR switch (col. 3, lines 27 – 60). It is because of inherent presence of an emitter-base junction capacitance, which accumulates the charges thus giving a rise to an accumulated base-emitter potential, i.e. potential bias. An evidence of inherency is provided by Boylestad et al. textbook Electronic Devices and Circuit Theory describing the semiconductor junction capacitance as being dependent on a value of an applied voltage (Fig. 1.33). According to Boylestad et al., with a forward (positive) bias the junction has a substantial value of a diffusion capacitance while with a reverse (negative) bias it has much smaller value of a depletion capacitance. Since the capacitance is non-linear and dependent on a value of

an applied signal, the junction is capable of accumulating predominantly positive charges due to its larger capacitance and therefore larger charge storage capability. Such accumulation of charges in the emitter-base junction of the SCR transistor makes possible firing the SCR by applying several periods of the high frequency wave while individual half way is not sufficient to fire it. When a bipolar wave of the high frequency signal becomes DC biased due to accumulation of positive charges in the emitter-base junction of the SCR, a peak value of the signal wave rises higher. Therefore, for the high frequency signal being barely sufficient for triggering the SCR due to its accumulated DC bias, its half period value alone (without DC bias) would not be sufficient for triggering.

An additional evidence of the presence of emitter-base junction capacitances the examiner provides the following US patents: Dumont et al. (US 4459531), col. 4 line 61 to col. 5 line 15, Yakushiji et al. (US 4982259), col. 1 lines 31-38) and Croft (US 5,546,038), col. 4 lines 46-58, Figs. 1A-1C).

Regarding claim 16 Switsen discloses the SCR switch receiving the high frequency control voltage to the control terminal through a capacitor (28 in Fig. 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3-6 are rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Yuan et al. (Patent Application Publication US 2002/0066904 A1). Regarding claim 3, Switsen discloses the method of claim 1. However, Switsen does not disclose wherein the high frequency is applied via an insulating layer formed above

a sensitive area of the component. Yuan et al. teaches wherein the high frequency voltage is applied via an insulating layer (Pg. 3 paragraph 33-34 & Fig. 1 element 104) formed above a starting area of the component (Pg. 3 paragraph 33-34 & Fig. 1 element 102).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen device with the Yuan et al. device features because both teach how to efficiently control the triggering of an semiconductor switch and the configuration of the radiation sensitive device (photodector) of Yuan et al. provides an apparatus with better isolation which will prevent erroneous triggering of the switch.

Regarding claim 4, Switsen in view of Yuan et al. disclose the method of claim 3. Yuan et al. further discloses wherein the high frequency voltage is applied above a gate region of a thyristor (Col. 4, paragraph 45).

Regarding claim 5, Switsen in view of Yuan et al. disclose the method of claim 3. Yuan et al. further discloses wherein the high frequency voltage is applied above a gate region of a triac (Col. 4, paragraph 45).

Regarding claim 6, Switsen further teaches the high frequency voltage being applied via a high-frequency line having terminals for connection to the high frequency voltage (14 and 18 in Fig. 1).

Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Yuan et al. and Spink (US 3824444). Regarding claim 7, Switsen in view of Yuan et al. does not disclose the high frequency being applied via a winding thru an external connection of the device. Spink teaches the high frequency voltage being applied via a winding that generates a magnetic field or responds to a magnetic field (Fig. 1 elements GT1, GT2, GT3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen and Yuan et al. device with the winding of Spink to provide better isolation for the control gate of the semiconductor.

Claims 8-11, 13, & 17- 21, 23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Iwamuro et al. (US 6091087).

Regarding claims 8 & 13 Switsen discloses an SCR-type switch component (a person of the ordinary skill will understand a method that is intrinsically described by the functioning of the apparatus) comprising two main electrodes (Fig. 1 anode and cathode of element 20) and at least one control electrode (Fig. 1 gate of element 20) controlling the SCR-type switch component in response to an unrectified high frequency power supply that supplies the accumulated effect on the SCR-type switch of applying the several periods in succession to start the SCR-type switch is an inherent characteristics of the SCR-type switch (see Claim 1 rejection above). The SCR-type switch has N-P junctions which inherently comprise parasitic capacitances that cause an accumulated effect of charges when a voltage is present at the electrodes.

Switsen does not specifically disclose that the SCR-type switch component with the gate formed on an insulating layer that insulates the control electrode from a starting region of the component (for claim 8).

Switsen does not specifically disclose that the control of the SCR-type switch controls without supplying current from the control terminal to the starting area of the SCR-type switch (for claim 13).

Iwamuro et al. teaches an insulated gate thyristor (Fig. 1), which has the gate, formed on an insulating layer that insulates the control electrode from a starting region of the component (9 <oxide film>, 10 <gate electrode>). Because of this insulation, there is no current supplied to the starting region of the component.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen device with the insulated gate thyristor of Iwamuro et al. because it greatly contributes to reduction of switching losses in a power switching apparatus using these devices (Iwamuro et al.;Col.18 lines 33-36).

Regarding claim 9, Iwamuro et al. further discloses the control electrode being arranged above a gate region of a thyristor (Fig. 1).

Regarding claim 10 Switsen in view of Iwamuro et al. discloses the SCR-type switch component of claim 8 but does not disclose the control electrode being arranged above a gate region of a triac.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen SCR device by arranging the control electrode above the gate region of triac, because a thyristor provides only unidirectional rectification and a triac would provide bidirectional rectification and therefore can be used for switching the AC voltage. Note that a triac is a configuration of a pair of thyristors connected in anti-parallel manner.

Regarding claim 11 Switsen in view of Iwamuro et al. discloses the SCR-type switch component of claim 8.

Switsen further teaches the control electrode being connected to a high-frequency line having terminals for connection to the high frequency power supply (14, 18 in Fig. 1).

Regarding claim 17 Switsen in view of Iwamuro et al. discloses the method of claim 13. Iwamuro et al. further teaches wherein the control terminal is insulated from the starting area (Fig. 1 elements 9 & 10).

Regarding claims 18-21 Switsen in view of Iwamuro et al. discloses the method of claims above.

Switsen further teaches the high-frequency control voltage comprising a plurality of halfwaves, wherein each one of the plurality of halfwaves is individually insufficient to turn on the SCR-type switch (see Claim 1 rejection above)

Regarding claim 23 Switsen in view of Iwamuro et al. discloses the method of claim 13. Switsen further discloses the high-frequency control voltage being unrectified

since the SCR gate is connected to the signal source through capacitor thus making sure that the signal is bipolar.

Claims 2, 14, 15, 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Iwamuro et al. and Hui et al. article Coreless transformers for Power MOSFET/IGBT Gate Drive Circuits. Regarding these Claims, Switsen although discloses the high frequencies but does not disclose frequencies in megahertz region. Hui et al. disclose that substantially simpler and cheaper structure of an isolation transformer for driving power semiconductors may be achieved by using PCB technology, which is possible only when using high enough frequencies, such as ranging from 500 Khz to 2 Mhz (see Abstract). It would have been obvious to one having ordinary skills in the art at the time the invention was made to increase the workable range from single and tens of KHz (Switsen) to 1 MHz or higher, because according to Hui et al. article it would considerably simplify a structure of the coupling transformer, which may be built in a form of printed traces on the top of PCB without using ferromagnetic core.

Regarding claim 25, Switsen discloses controlling the SCR-type wherein the control signal is provided to the gate through a capacitor (28 in Fig. 1).

As to a workable range of frequencies ranging to 1 Mhz or higher, Switsen in view of J. A. Hui et al. discloses use of frequencies up to 2 Mhz for driving power semiconductors. A motivation for modification of the primary reference is the same as above.

Claims 12 & 24 are rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Iwamuro et al. and Spink (US 3824444). Regarding claim 12 Switsen in view of Iwamuro et al. discloses the SCR-type switch component of claim 8.

Switsen in view of Iwamuro et al. does not disclose the high frequency being applied via a winding that generates a magnetic field or responds to a magnetic field.

Spink teaches application of the high frequency via a winding that generates a magnetic field or responds to a magnetic field (Fig. 1 elements GT1, GT2, GT3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen in view of Iwamuro et al. because a particular technique of coupling the triggering signal to the gate of the SCR through the coupling transformer was recognized as part of ordinary capabilities of one of ordinary skill in the art.

Regarding claim 24 Switsen in view of Iwamuro et al. discloses the method of claim 13. Spink teaches wherein the high frequency is applied via a winding that generates a magnetic field or responds to a magnetic field (Fig. 1 elements GT1, GT2, GT3).

Claims 27-28, 30-39 & 41-45 are rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Bhagat (US 4630092).

Regarding claim 27 Switsen discloses an SCR-type switch component (Fig. 1 element 20), comprising two main electrodes (Fig. 1 anode and cathode of element 20) and at least one control electrode (Fig. 1 gate of element 20) controlling the SCR-type switch component in response to an unrectified high frequency power supply. The input high frequency signal passes the capacitor (28 in Fig. 1) and therefore is un-rectified.

The SCR-type switch is controlled by applying a high-frequency control voltage to the control electrode (gate g in Fig. 1), the accumulated effect on the SCR-type switch of applying the several periods in succession to start the SCR-type switch is an inherent characteristics of the SCR-type switch (see Claim 1 rejection above). The SCR-type switch has N-P junctions which inherently comprise parasitic capacitances, which inherently comprise parasitic capacitances that generate an accumulated effect of charges when a voltage is present at the electrodes.

Switsen does not specifically define the starting region and insulating region.

Bhagat teaches a starting region (Fig. 2 elements 32, 34, 36) and insulating region (Fig. 2 elements 40, 46).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen device with the insulated gate thyristor of Bhagat because this thyristor with an insulated gate provides rapid turn-off even when the anode voltage stays high (Bhagat <Col. 1 lines 66-68>).

Regarding claim 28 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further discloses the first control electrode being completely insulated from the starting region (Fig. 2 elements 42, 40, 46).

Regarding claim 30 Switsen in view of Bhagat discloses the SCR-type switch method of claim 27.

Switsen further discloses the control electrode being capacitively coupled to the source of the high frequency signal (14, 18 in Fig. 1). In Switsen circuit modified according to teachings of Bhagat, the first control electrode is being capacitively coupled to the starting region via the insulating region.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen in view of Bhagat device because it provides isolation from the driving circuit by providing AC coupling.

Regarding claim 31 Switsen in view of Bhagat discloses the SCR-type switch method of claim 30.

Bhagat further teaches wherein the first control electrode contacts the insulating region (Fig. 2 elements 44, 40).

Regarding claim 32 Switsen in view of Bhagat discloses the SCR-type switch method of claim 31.

Bhagat further teaches wherein the insulating region contacts the starting region (Fig. 2 elements 40, 32, 34, 36).

Regarding claim 33 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further discloses wherein the first control electrode is insulated, via the insulating layer, from a semiconductor substrate in which semiconductor layers of the SCR-type switch component are formed (Fig. 2).

Regarding claim 34 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further discloses a second control electrode that is insulated from the starting region by the insulating region (Fig. 2 elements 42, 40, 46)

Regarding claim 35 Switsen in view of Bhagat discloses the SCR-type switch of claim 27. Bhagat further discloses wherein the starting region comprises a first region of a first conductivity type (Fig. 2 element N) and a second region of a second conductivity type (Fig. 2 element P), wherein the first control electrode is closer to the first region than to the second region (Fig. 2 element 44, N), and wherein the second control electrode is closer to the second region than to the first region (Fig. 2 element 42, PN).

Regarding claim 36 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further discloses wherein the first control electrode contacts the insulating region (Fig. 2 elements 44, 40, 46).

Regarding claim 37 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further discloses the insulating region contacting the starting region (Fig. 2 elements 40, N).

Regarding claim 38 Switsen in view of Bhagat discloses the SCR-type switch of claim 27 but does not disclose the control electrode being arranged above a gate region of a triac.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen in view of Bhagat device with a triac because a thyristor provides only unidirectional rectification and a triac would provide bidirectional rectification. Note that a triac is a configuration of a pair of thyristors connected back to back.

Regarding claim 39 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen SCR device by replacing the SCR type switch by thyristor because a thyristor provides only unidirectional rectification and a triac would provide bidirectional rectification and therefore can be used for switching the AC voltage. Note that a triac is a configuration of a pair of thyristors connected in anti-parallel manner.

Regarding claim 41 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Switsen further teaches the effect of the plurality of halfwaves of the high-frequency control voltage being applied to the control electrode close enough in time (high-frequency) and large enough in intensity such that the accumulated effect of the plurality of halfwaves gradually increases over time and thereby turns on the SCR-type switch, wherein the SCR-type switch is not turned on in a response to an effect of an individual one of the plurality of halfwaves applied by itself (see Claim 1 rejection above)

Claim 42 is rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Bhagat and Hui et al. article.

Regarding claim 42 Switsen in view of Bhagat discloses the SCR-type switch of claim 27 except for the range of 1 MHz or higher. Hui et al. disclose that substantially

simpler and cheaper structure of an isolation transformer for driving power semiconductors may be achieved by using PCB technology, which is possible only when using high enough frequencies, such as ranging from 500 Khz to 2 Mhz (see Abstract). It would have been obvious to one having ordinary skills in the art at the time the invention was made to increase the workable range from single and tens of KHz (Switsen) to 1 MHz or higher, because according to Hui et al. article it would considerably simplify a structure of the coupling transformer, which may be built in a form of printed traces on the top of PCB without using ferromagnetic core.

Regarding claim 43 Switsen in view of Bhagat discloses the SCR-type switch of claim 27.

Bhagat further teaches wherein the high-frequency control voltage controls the SCR-type switch without supplying current from the control terminal to the starting area (Fig. 2 elements 40, 46 <these insulations do not allow conduction of current>).

Regarding claims 44-45, Switsen further discloses providing to the SCR-type switch a plurality of halfwaves of high frequency voltage in succession, creating an accumulated effect to turn on the SCR-type switch; the accumulated effect on the SCR-type switch of applying the several periods in succession to start the SCR-type switch is an inherent characteristic of the SCR-type switch (see Claim 1 rejection above). The SCR-type switch has N-P junctions which inherently comprise parasitic capacitances that generate an accumulated effect of charges when a voltage is present at the electrodes.

Claim 29 is rejected under 35 U.S.C. §103(a) as being unpatentable over Switsen in view of Bhagat and Spink (US 3824444).

Regarding claim 29 Switsen in view of Bhagat disclose the SCR-type switch method of claim 27.

However, it does not disclose wherein the control electrode is inductively coupled to the starting region via the insulating region. Spink teaches wherein the control

electrode is inductively coupled to the starting region via the insulating region (Fig. 1 elements GT1, GT2, GT3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the Switsen in view of Bhagat device with the winding of Spink to provide better isolation for the control gate of the semiconductor.

Response to Arguments

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zeev Kitov whose current telephone number is (571) 272 - 2052. The examiner can normally be reached on 8:00 – 4:30. If attempts to reach examiner by telephone are unsuccessful, the examiner's supervisor, Michael Sherry can be reached on (571) 272 – 2800, Ext. 36. The fax phone number for organization where this application or proceedings is assigned is (571) 273-8300 for all communications.

/Michael J Sherry/
Supervisory Patent Examiner, Art Unit 2836

/Z.K./
Examiner, Art Unit 2836
7/30/2008